

REMARKS

Entry of this Amendment under 37 C.F.R. § 1.116 is respectfully requested. The response and accompanying Declaration do not require any additional search. The Declaration is being submitted due to the Examiner's position that lactic acid is a chelator. The Declaration was not submitted earlier since applicant's attorney did not feel it necessary to provide expert testimony relating to the chemistry of chelation. In view of this, it is respectfully requested that the Declaration under 37 C.F.R. § 1.132 be accepted even though this response is to a Final Office Action.

The Office Action rejected claims 1-14, 19-34, and 41-61 under 35 U.S.C. 102(b) or in the alternative under 35 U.S.C. 103(a) as obvious over Blazey et al. (U.S.Pat. No. 6,177,118). The Office Action stated that Blazey et al teach a method of making a cheese base and cheese comprising mixing milk or a milk derivative with citric acid to a pH of about 5.0 to 6.8 and ultrafiltering the treated milk. The Examiner further stated that Blazey et al. also teach the addition of emulsifying salts and that the pH adjustment occurs without precipitation in column 6, lines 56-63. The Office action stated that claims differ as to the specific recitation of chelation and that chelation is inherent and/or obvious to that of Blazey et al. as the same components and process steps are used. The Office Action also stated that Example 1 teaches pH adjustment and then an additional step of quiescently holding wherein the acidified milk is held and that the Applicant does not exclude this step.

Applicant respectfully disagrees. With regard to the addition of citric acid in Blazey et al. without precipitation, the Examiner cited Blazey et al. col. 6, lines 56-63. Applicant submits that at col. 6, lines 56-63 of Blazey et al. the citric acid and lactic acid are added to the retentate after ultrafiltration of the acidified milk. In the method of Blazey et al., the calcium is not chelated prior to filtration, thus the calcium in the milk is still present in the retentate. In contrast, in the present invention, a chelating agent is added to chelate the calcium prior to ultrafiltration, thus the calcium passes through the membrane with the permeate and the retentate has reduced calcium.

Furthermore, Blazey et al. teach only adjusting the pH of the milk not chelation of calcium. See col. 6, lines 27-30. The only compound that is specifically mentioned for

acidification is the use of lactic acid in the Examples. Addition of lactic acid changes the pH of a solution but it does not chelate the calcium as is required in the process of the present invention. Applicant has attached a Declaration under U.S.C. 132 by Dr. Lloyd Metzger pertaining to the fact that lactic acid is not a chelation agent. In addition, Applicant has attached a product list from Sigma-Aldrich's website. This list provides a number of compounds that are chelating agents including citric acid, but does not list lactic acid as a chelating agent. This evidence supports the Applicant's assertion that lactic acid is not a chelating agent. Thus, chelation is not inherent in Blazey et al. because chelation does not occur in the methods taught by Blazey et al. In particular, the Examples of Blazey et al. recite the use of lactic acid as the acidifying agent prior to ultrafiltration and as discussed above, lactic acid is not a chelator.

According to the Federal Circuit, "To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either explicitly or inherently." *In re Schreiber*, 44 USPQ2d 1429, 1431 (Fed.Cir. 1997). Applicant submits that Blazey et al does not explicitly teach chelation.

Applicant also submits that Blazey et al. does not inherently teach chelation. According to the MPEP, "Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." See MPEP 2112-IV. In addition, according to the Federal Circuit, "Occasional results are not inherent." See *Mehl/Biophile Intl. Corp. v. Milgraum* 52 USPQ 2d 1306. Blazey et al generally teaches acidification of milk prior to filtration and that any acid, organic or inorganic acid, may be used to achieve the desired pH. Chelation generally does not occur when these acids are used. An occasional acid, for example, citric acid can also act as a chelating agent. Even then, the conditions for chelating the calcium in the present invention includes having the milk in a turbulent state not a quiescent state as in Blazey et al. Therefore, Applicant submits that chelation does not occur and is not inherent in Blazey et al.

Furthermore, the present invention is not obvious in view of Blazey et al. because Blazey et al. teach away from the present invention. Blazey et al. teach holding the milk in a quiescent state not a turbulent state as recited in all of the independent claims 1, 19 and 41. Blazey et al teach direct acidification which is known to be performed under quiescent conditions. Blazey et

al. does not teach or suggest chelating the calcium in order to reduce the calcium in the retentate. In fact, in the Examples provided, lactic acid is used to adjust the pH and it is a well-established fact that lactic acid is not a calcium chelator.


Based on the discussion above, Applicant requests the withdrawal of the rejections under 35 U.S.C. 102(b) or alternatively under 35 U.S.C. 103(a) over Blazey et al.

It is believed that the claims, as written, are allowable over the prior art and allowance of the claims is respectfully requested.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

WESTMAN, CHAMPLIN & KELLY, P.A.

By:   
Z. Peter Sawicki, Reg. No. 30,214  
Suite 1400  
900 Second Avenue South  
Minneapolis, Minnesota 55402-3319  
Phone: (612) 334-3222 Fax: (612) 334-3312

ZPS:cnm

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named  
Inventor : Craig J. Schroeder

Appln. No.: 10/799,252

Filed : March 12, 2004

For : PROCESS FOR THE MANUFACTURE OF  
CHEESE BASE AND THE PRODUCTS  
MADE THEREFROM

Group Art Unit: 1761

Examiner: L. Wong

Docket No.: L111.12-0102

DECLARATION UNDER 37 C.F.R. § 1.132

VIA ELECTRONIC FILING

Commissioner for Patents

Sir:

I, Lloyd Metzger hereby declare as follows:

1. I am currently an Associate Professor, in the Dairy Science Department of South Dakota State University in Brookings, South Dakota.
2. I received a Bachelor of Science Degree in Dairy Manufacturing with a minor in Chemistry in 1992 from South Dakota State University in Brookings, South Dakota. Thereafter, I received a Master in Science Degree in Dairy Science in 1994 from South Dakota State University in Brookings, South Dakota. Thereafter, I was awarded the degree of Ph.D. in Food Science and minors in Biochemistry and Agricultural Resources from Cornell University in Ithaca, New York in 1999.
3. From 1998 to 2000, I held a position as a Research Food Scientist at General Mills in Minneapolis, MN where I developed proprietary technologies including five patents, interacted with product development teams to convert a proprietary technology into a product offering resulting in a multi-million dollar cost saving.
4. From 2000 to 2006, I held a position as Assistant Professor and Associate Professor in the Department of Food Science and Nutrition at the University of Minnesota in St. Paul, Minnesota.
5. From 2003-present, I have been serving as Director of the Midwest Dairy Foods Research Center at the University of Minnesota, St. Paul, Minnesota.

6. From 2007-present, I have been holding a position as Associate Professor in the Dairy Science Department at South Dakota State University in Brookings, South Dakota.
7. I am experienced in the field of evaluating the structural and functional roles of the various components in cheese and fermented dairy products, developing modified manufacturing parameters to control cheese functional properties and enhancing the nutritional benefits of dairy products.
8. I am an author/coauthor of two book chapters and numerous refereed publications.
9. I am a named inventor in 6 patents and 2 patent applications.
10. A Curriculum Vitae of my educational background and my professional career is attached hereto as Exhibit A.
11. I have experience related to chelation, chelating agents, and organic acids.
12. I hereby declare that citric acid is known to function as a chelating agent. In particular, citric acid is a known chelator of calcium ions.
13. I further declare that lactic acid is an organic acid that may be used for adjusting the pH of a solution. Lactic acid is not a chelating agent. A chelating agent has at least two functional groups that donate a pair of electrons and must be located so as to allow ring formation with the metal. Based on these conditions, lactic acid is not functional as a chelating agent.
14. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the above-referenced application or a patent issuing thereon.

Declarant:

Lloyd Metzger  
(Printed Name)

Declarant:

  
(Signature)

Date:

1/31/08

## Lloyd E. Metzger

### Home Address

1018 Western Avenue  
Brookings, SD 57006  
ph: (612) 237-5112

### Office Address

South Dakota State University  
Dairy Science Department  
Box 2104 Dairy-Micro Bld.  
Brookings, SD 57007  
ph: (605) 688-5477

### **Education:**

Ph.D. in Food Science, Cornell University, Ithaca, NY. January 1999.  
Minors in Biochemistry and Agriculture Resources - Managerial economics  
Dissertation title: Improving the appearance and functional properties of low fat Mozzarella cheese.

MS in Dairy Science, South Dakota State University, Brookings, SD. August 1994.  
Supporting Field: Statistics  
Thesis title: Effect of homogenization on quality of reduced-fat Cheddar cheese.

BS in Dairy Manufacturing, South Dakota State University, Brookings, SD. May 1992.  
Minor: Chemistry

### **Work Experience:**

Associate Professor, Alfred Chair in Dairy Education: Jan 2007 – Present. Dairy Science Department, South Dakota State University, Brookings, SD. Teaching and conducting research in Dairy product analysis, dairy chemistry, and dairy processing.

Director, Midwest Dairy Foods Research Center: Jan 2003 – present. Department of Food Science and Nutrition, University of Minnesota, St. Paul, MN. Oversee the submission, review, and reporting of dairy related research projects. The 2006 budget was \$746,526 and included 32 active projects.

Associate Professor: July 2006 – Dec 2006

Assistant Professor: July 2000 – July 2006. Department of Food Science and Nutrition, University of Minnesota, St. Paul, MN. Teaching and conducting research in food analysis, dairy chemistry, and food proteins.

Research Food Scientist: Nov 1998 - July 2000. General Mills, Minneapolis, MN. Developed proprietary technologies including five patents that were used to differentiate and add consumer value to Betty Crocker products; interacted with a product development team (consumer research, supply chain, processing, marketing, and financial) to convert a proprietary technology into a product offering resulting in a multi-million dollar annual cost savings.

### **Research interests:**

Evaluating the structural and functional roles of the various components in cheese and fermented dairy products, developing modified manufacturing parameters to control cheese functional properties, and enhancing the nutritional benefits of dairy products.

### **Honors and Awards:**

American Dairy Science Association Foundation Scholar, 2005  
General Mills Bell Achievement Award for Discovery, 1999  
ADSA Graduate Student Scientific Paper Presentation in Dairy Manufacturing Award, 1998  
Ruth and Henry Herzog Graduate Research Award, 1997

Clinton Dewitt Fellowship, 1997  
Sigma Xi Research Proposal Award, 1994

## **Publications:**

### **Patent applications**

Metzger, L. E. and D. Grindstaff. August 5, 2005. Cheese with sodium gluconate to inhibit calcium lactate crystal formation. U.S. Pat. App. No. 11/197,956.

Metzger, L. E. and D. Grindstaff. August 7, 2006. Cheese with calcium lactate crystal inhibitor. U.S. Pat. App. No. 11/500,176.

### **Patents**

Metzger, L. E. 2006. Method of bleaching cereal grains. General Mills, Inc., assignee U.S. Pat. No. 7,101,580

Monsalve-Gonzalez, A., L.E. Metzger, A. Prakash, M. S. Valanju, and J. G. Roufs. 2005. Bleach bran and bran products. General Mills, Inc, assignee. U.S. Pat. No. 6,899,907

Metzger, L. E. 2002. Method of bleaching cereal grain. General Mills, Inc, assignee. U.S. Pat. No. 6,497,909

Metzger, L. E. and C. Jones. 2002. Process of milling hard white wheat and products thereof. General Mills, Inc, assignee. U.S. Pat. No. 6,372,281.

Narayanaswamy, V., L. E. Metzger, J. E. Langer, and D. W. Tobelmann. 2001. Shelf stable batter article and method of preparation. General Mills, Inc, assignee. U.S. Pat. No. 6,224,924.

Narayanaswamy, V., L. E. Metzger, J. E. Langer, D. W. Tobelmann, and L. R. Kreisman. 2000. Shelf stable batter article and method of preparation. General Mills, Inc, assignee. U.S. Pat. No. 6,165,524.

### **Book chapters**

Metzger, L. E. 2003. Chapter 1 - Nutritional labeling using a computer program *in* Food analysis Laboratory manual, S. S. Nielsen, ed. Kluwer Academic, New York, NY.

Nielsen, S. S. and L. E. Metzger. 2003. Chapter 3 - Nutrition labeling *in* Food Analysis. 3rd Ed., S.S. Nielsen, ed. Kluwer Academic, New York, NY.

## Refereed Publications

Liu, X. and L. E. Metzger. 2007. Application of fluorescence spectroscopy for monitoring changes in nonfat dry milk during storage. *J. Dairy. Science.* 90:24-37.

Upreti, P and L. E. Metzger. 2007. Influence of calcium and phosphorus, lactose, and salt-to-moisture ratio on Cheddar cheese quality: pH changes during ripening. *J. Dairy Science.* 90:1-12.

Gangidi, R. R. and L. E. Metzger. 2006. Ionic calcium determination in skim milk with molecular probes and front-face fluorescence spectroscopy: simple linear regression. *J. Dairy Science.* 89:4105-4113.

Godden, S., S. McMartin, J. Feirtag, J. Stabel, R. Bey, S. Goyal, L. Metzger, J. Fetrow, S. Wells, and H. Chester-Jones. 2006. Heat-treatment of bovine colostrum. II. Effects of heating duration on pathogen viability and Immunoglobulin G. *J. Dairy Sci.* 89:3476-3483.

Chevanan, K. Muthukumarappan, P. Upreti, and L. E. Metzger. 2006. Effect of calcium and phosphorus, residual lactose and salt-to-moisture ratio on texture properties of Cheddar cheese during ripening. *J. Texture Studies.* 37:711-730

Garimella Purna, S. K., A. Pollard, and L. E. Metzger. 2006. Effect of formulation and manufacturing parameters on process cheese food functionality: 1. Trisodium citrate. *J. Dairy Sci.*

Upreti, P., P. Buhlmann, and L. E. Metzger. 2006. Influence of calcium and phosphate, residual lactose, and salt-to-moisture ratio on Cheddar cheese quality: pH buffering properties of cheese. *J. Dairy Science.* 89:420-428.

McMartin, S., S. Godden, L. Metzger, J. Feirtag, R. Bey, , J. stable, J. Fetrow, S. Wells, and H. Chester-Jones. 2006. Heat treatment of bovine colostrum. I: Effects of temperature on viscosity and Immunoglobulin G level. *J. Dairy Science.* 89:2110-2118.

Upreti, P. and L. E. Metzger. 2006. Utilization of fourier transform infrared spectroscopy for measurement of organic phosphorus and bound calcium in Cheddar cheese. *J. Dairy Science.* 89:1926-1937.

Upreti, P., L. L. McKay, and L. E. Metzger. 2006. Influence of calcium and phosphate, residual lactose, and salt-to-moisture ratio on Cheddar cheese quality: Changes in residual sugars and water soluble organic acid during ripening. *J. Dairy Science.* 89:429-443.

Upreti, P., L. E. Metzger, and K. D. Hayes. 2006. Influence of calcium and phosphate, residual lactose, and salt-to-moisture ratio on Cheddar cheese quality: Proteolysis during ripening. *J. Dairy Science.* 89:444-453.

Upreti, P. and L. E. Metzger. 2006. Influence of calcium and phosphate, residual lactose, and salt-to-moisture ratio on Cheddar cheese quality: Manufacture and composition. *J. Dairy Science.* 89:420-428.

Amingo, E. R. and L. E. Metzger. 2005. Effect of soaking and blanching on the quality of African yam bean seed. *Plant Foods for Human Nutrition.* 60:165-171.

Kapoor, R. and L. E. Metzger. 2005. Small-scale manufacture and analysis of process cheese using a Rapid Visco Analyser. *J. Dairy Science* 88:3382-3391.



- Prow, L. A. and L. E. Metzger. 2005. Melt analysis of process cheese spread/product using a rapid visco analyzer. *J. Dairy Science*. *J. Dairy Science* 88:1277-1287.
- Purna, S. K. , L. A. Prow, and L. E. Metzger. 2005. Utilization of front face fluorescence spectroscopy for analysis of process cheese. *J. Dairy Science* 88:470-477.
- Kapoor, R., P. Lehtola, and L. E. Metzger. 2004. Comparison of pilot-scale and rapid visco analyzer process cheese manufacture. *J. Dairy Science* 87:2813-2821.
- Kapoor, R. and L. E. Metzger. 2004. Evaluation of salt whey as an ingredient in process cheese. *J. Dairy Sci.* 87:1143-1150.
- Upreti, P., L. E. Metzger and P. Buhlmann. 2004. Glass and polymeric membrane electrodes for the measurement of pH in milk and cheese. *Talanta*. 63:139-148.
- Metzger, L. E., R. Kapoor, L. A. Rosenberg, P. Upreti. 2002. RVA: Process cheese manufacture. *Australian J. Dairy Tech.* 57:136.
- Metzger, L. E., D. M. Barbano, and P. S. Kindstedt. 2001. Effect of milk preacidification on low fat Mozzarella cheese. III. Post-melt chewiness and whiteness. *J. Dairy Sci.* 84:1357.
- Metzger, L. E., D. M. Barbano, P. S. Kindstedt, and M. R. Guo. 2001. Effect of milk preacidification on low fat Mozzarella cheese. II. Chemical and functional properties during refrigerated storage. *J. Dairy Sci.* 84:1348.
- Metzger, L. E., D. M. Barbano, M. A. Rudan, and P. S. Kindstedt. 2000. Effect of milk preacidification on low fat Mozzarella cheese. I. Composition and yield. *J. Dairy Sci.* 83:648
- Metzger, L. E., D. M. Barbano, M. A. Rudan, P. S. Kindstedt, and M. R. Guo. 2000. Whiteness change during heating and cooling of Mozzarella cheese. *J. Dairy Sci.* 83:1
- Metzger, L. E. and D. M. Barbano. 1999. Measurement of postmelt chewiness of Mozzarella Cheese. *J. Dairy Sci.* 82:2274
- Chouinard, P. Y., L. Courneau, D. M. Barbano, L. E. Metzger, and D. E. Bauman. 1999. Conjugated linoleic acids alter milk fatty acid composition and inhibit milk fat secretion in dairy cows. *J. Nutr.* 129:1579.
- Mistry, V. V., L. E. Metzger, and J. L. Maubois. 1996. Use of ultrafiltered sweet cream buttermilk in the manufacture of reduced fat Cheddar cheese. *J. Dairy Sci.* 79:1137.
- Metzger, L. E. and V. V. Mistry. 1995. A new approach using homogenization in the manufacture of reduced fat Cheddar cheese. 2. Microstructure, fat globule distribution and free oil. *J. Dairy Sci.* 78:1883.
- Metzger, L. E. and V. V. Mistry. 1994. A new approach using homogenization of cream in the manufacture of reduced fat Cheddar cheese. 1. Manufacture, composition and yield. *J. Dairy Sci.* 77:3506

## Abstracts

- McMartin, S, S. Godden, J. Feirtag, L. Metzger, R. Bey, and S. Goyal. 2005. Effect of pasteurization temperature on Immunoglobulin G, viscosity and pathogen viability in bovine colostrums. *Am Assoc.*

Biswas, A. C., R. Kapoor, L. E. Metzger, and K. Muthukumarrapan. 2005. Evaluation of process cheese food functionality using various melt-tests. J. Dairy Sci. Supple. 1 (Abstract).

Garimella Purna, S. K., A. Pollard, and L. E. Metzger. 2005. Effect of formulation and manufacturing parameters on process cheese food functionality- I. tri-sodium citrate. J. Dairy Sci. Supple. 1 (Abstract).

Garimella Purna, S. K., A. Pollard, and L. E. Metzger. 2005. Effect of formulation and manufacturing parameters on process cheese food functionality- II. Di-Sodium Phosphate. J. Dairy Sci. Supple. 1 (Abstract).

Kapoor, R., S. K. Garimella Purna, and L. E. Metzger. 2005. Effect of mixing speed during manufacture and type and level of emulsifying salt used on the microstructure of process cheese. J. Dairy Sci. Supple. 1 (Abstract).

Upreti, P., L. L. McKay, and L. E. Metzger. 2005. Influence of calcium, phosphorus, residual lactose, and salt-to-moisture ratio (S/M) of Cheddar cheese on glycolysis during ripening. J. Dairy Sci. Supple. 1 (Abstract).

Upreti, P., P. S. Lehtola, and L. E. Metzger. 2005. Influence of calcium, phosphorus, residual lactose, and salt-to-moisture ratio (S/M) of Cheddar cheese on proteolysis during ripening. J. Dairy Sci. Supple. 1 (Abstract).

Metzger, L. E. 2004. Utilization of a Rapid Visco Analyzer for measurement of the rheological properties of dairy products. J. Food Sci. (Suppl. 1) (Abstr.).

Biswas, A. C., R. Kapoor, P. Upreti, L. Metzger and K. Muthukumarappan. 2004. Influence of natural cheese characteristics on process cheese functionality: Dynamic viscoelastic properties. J. Dairy Sci. Supple. 1 (Abstract).

Biswas, A. C., R. Kapoor, P. Upreti, L. Metzger and K. Muthukumarappan. 2004. Influence of natural cheese characteristics on process cheese functionality: Unmelted and melted properties. J. Dairy Sci. Supple. 1 (Abstract).

Pollard, A. and L. E. Metzger. 2004. The influence of non-fat dry milk characteristics on yogurt functionality. J. Dairy Sci. Supple. 1 (Abstract).

Ottman, K. A. and L. E. Metzger. 2004. Direct acidification and cream homogenization for Mozzarella cheese manufacture. J. Dairy Sci. Supple. 1 (Abstract).

Prow, L. A. and L. E. Metzger. 2004. Evaluation of process cheese spread meltability using a Rapid Visco Analyzer. J. Dairy Sci. Supple. 1 (Abstract).

Pandya, N. C., R. I. Dave, A. N. Hassan, and L. E. Metzger. 2004. Feasibility of exo-polysaccharide production in whey mineral concentrate. J. Dairy Sci. Supple. 1 (Abstract)

Lehtola, P. and L. E. Metzger. 2004. A Comparison of three different methods for measuring intact casein in cheese. J. Dairy Sci. Supple. 1 (Abstract).

Kapoor, R., A Pollard, P Upreti, L. E. Metzger. 2004. Developments in the small scale manufacture

of process cheese using RVA. J. Dairy Sci. Supple. 1 (Abstract).

Shivananda, K. G., L. A. Prow, L. E. Metzger. 2004. Utilization of front face fluorescence spectroscopy for rapid analysis of process cheese functionality. J. Dairy Sci. Supple. 1 (Abstract).

Upreti, P., L. E. Metzger. 2004. Influence of calcium, phosphorus, residual lactose, and salt-to-moisture ratio on cheese quality: manufacture and composition. J. Dairy Sci. Supple. 1 (Abstract).

Upreti, P., L. E. Metzger. 2004. Influence of calcium, phosphorus, residual lactose, and salt-to-moisture ratio on cheese quality: pH changes during ripening. J. Dairy Sci. Supple. 1 (Abstract).

Miaka, S., L. E. Metzger, K. S. Baldwin, and L. L. McKay. 2003. Characterization of proteolysis in cheddar cheese produced with isogenic, thermolytic starters expressing various cell envelope proteinases. J. Dairy Sci. Supple. 1 (Abstract).

Upreti, P. and L. E. Metzger. 2003. Analysis of physico-chemical changes during early ripening of cheese utilizing FTIR spectroscopy. J. Dairy Sci. Supple. 1 (Abstract).

Kapoor, R. and L. E. Metzger. 2003. Evaluation of salt whey as an ingredient in process cheese, J. Dairy Sci. Supple. 1 (Abstract).

Metzger, L. E., P. Lehtola, and R. Kapoor. 2003. Comparison of pilot-scale and RVA process cheese manufacture. J. Dairy Sci. Supple. 1 (Abstract).

Rosenberg, L. A. and L. E. Metzger. 2003. Comparison of the melting properties of process cheese using a Rapid Visco Analyzer (RVA) and the Schreiber melt test. J. Dairy Sci. Supple. 1 (Abstract).

Rosenberg, L. A., L. E. Metzger, M. R. Acharya, and V. V. Mistry. 2002. Evaluation of process cheese melting characteristics using a Rapid Visco Analyzer. J. Food Sci. (Suppl. 1) (Abstr.).

Myaka, S. I., L. E. Metzger, L. L. McKay, and K. S. Baldwin. 2002. Influence of Lactococcal cell envelope proteinases on accelerated Cheddar cheese ripening. J. Dairy Sci. (Suppl. 1) (Abstract).

Metzger, L. E. and M. L. Leman. 2001. Measurement of temperature dependent changes in process cheese viscosity. J. Dairy Sci. (Suppl. 1):(Abstr.).

Haidari, F., L. E. Metzger, and D. E. Smith. 2001. Characterization of dephosphorylated b-casein. J. Dairy Sci. (Suppl. 1):(Abstr.).

Guo, M. R., P. S. Kindstedt, L. E. Metzger, M. A. Rudan, and D. M. Barbano. 1999. Effect of milk preacidification on the serum phase of low fat Mozzarella cheese. J. Dairy Sci.(Suppl. 1):(Abstr.).

Lee, F. L., G. M. Hendricks, P. S. Kindstedt, L. E. Metzger, M. A. Rudan, and D. M. Barbano. 1999. Microstructural analysis of low moisture part skim and low fat Mozzarella cheese by confocal laser scanning microscopy. J. Dairy Sci.(Suppl. 1):(Abstr.).

Metzger, L. E., D. M. Barbano, M. A. Rudan, P. S. Kindstedt, and M. R. Guo. 1998. Whiteness change during heating and cooling of Mozzarella cheese. J. Dairy Sci.(Suppl. 1):(Abstr.).

Metzger, L. E., D. M. Barbano, M. A. Rudan, and P. S. Kindstedt. 1998. Milk pre-acidification for low fat Mozzarella: Impact on cheese yield. J. Dairy Sci.(Suppl. 1):(Abstr.).

- Metzger, L. E., D. M. Barbano, M. A. Rudan, and P. S. Kindstedt. 1998. Milk pre-acidification with acetic and citric acid: Calcium content and post-melt chewiness. J. Dairy Sci.(Suppl. 1):(Abstr.).
- Metzger, L. E., D. M. Barbano, M. A. Rudan, and P. S. Kindstedt. 1998. Milk pre-acidification with citric acid: Impact on characteristics of low fat Mozzarella cheese. J. Dairy Sci.(Suppl. 1):(Abstr.).
- Chouinard, P. Y., L. Corneau, D. E. Bauman, L. E. Metzger, D. M. Barbano. 1998. Milk yield and composition during infusion of conjugated linoleic acid in dairy cows. J. Dairy Sci.(Suppl. 1):(Abstr.).
- Metzger, L. E. and D. M. Barbano. 1997. Quantitative measurement of post-melt chewiness of Mozzarella cheese. J. Dairy Sci. 80(Suppl. 1):(Abstr.).
- Rudan, M. A., L. E. Metzger, and D. M. Barbano. 1997. "A dynamic model of full and fat-free melting and browning". J. Dairy Sci. 80(Suppl. 1):(Abstr.).
- Metzger, L. E. and D. M. Barbano. 1996. Effect of fat content and protein type on milk fat globule size and protein adsorption produced by homogenization. J. Dairy Sci.(Suppl. 1):(Abstr.).
- Mistry, V. V. , L. E. Metzger, D. L. Anderson and J. L. Maubois. 1995. Use of ultrafiltered sweet cream buttermilk in the manufacture of reduced fat Cheddar cheese. J. Dairy Sci. (Suppl. 1):(Abstr.).
- Mistry, V. V. and L. E. Metzger. 1994. Application of cream homogenization in reduced fat processed cheese manufacture. J. Dairy Sci. (Suppl. 1):(Abstr.).
- Metzger, L. E. and V. V. Mistry. 1993. Effect of homogenization on quality of reduced-fat Cheddar cheese. 1. Manufacture composition and yield. J. Dairy Sci. (Suppl. 1):(Abstr.).
- Metzger, L. E. and V. V. Mistry. 1993. Effect of homogenization on quality of reduced-fat Cheddar cheese. 2. Rheology and microstructure. J. Dairy Sci. (Suppl. 1):(Abstr.).

## Research Grants and Contracts

### As Principal Investigator

#### *External grants:*

1. **Title:** Effect of calcium and phosphate on process cheese meltability, PI Metzger, Co-PI Kasiviswanathan Muthukumarappan, Dairy Management Inc.  
**Duration and funding:** 1/1/03-12/31/05, \$124,634
2. **Title:** Production of Parmesan and cottage cheese utilizing commercial American type cheese manufacturing equipment, PI Metzger, Dairy Management Inc.  
**Duration and funding:** 5/1/03-12/31/04, \$21,580
3. **Title:** The use and performance of process cheese in retort foods, PI Metzger, Dairy Management Inc.  
**Duration and funding:** 9/01/03-12/31/04, \$72,082
4. **Title:** Development of analytical techniques for measurement of NFDM functionality, PI L. Metzger, Dairy Management Inc.  
**Duration and funding:** 1/1/05-12/31/06, \$98,708
5. **Title:** Novel approach for producing process cheese with reduced sodium content, PI L. Metzger, Dairy Management Inc.

***Duration and funding:*** 1/1/05-12/31/06, \$77,019

6. **Title:** Development of a mathematical model to predict the distribution of calcium in cheese, PI L. Metzger, Midwest Advanced Food Manufacturing Alliance.

***Duration and funding:*** 9/1/05-8/31/06, \$93,745

7. **Title:** Fortification of milk, yogurt and process cheese with Vitamin D, PI L. Metzger, Dairy Management Inc.

***Duration and funding:*** 9/1/05-9/1/06, \$91,916

8. **Title:** Processing cheese fines into a value added ingredient, PI L. Metzger, Dairy Management Inc.

***Duration and funding:*** 9/1/05-12/31/06, \$56,500

***University/Internal grants:***

1. **Title:** Measurement of temperature dependent changes in viscosity of process cheese, PI Metzger, Midwest Dairy Association.

***Duration and funding:*** 5/1/01-12/31/03, \$59,500

2. **Title:** Effect of milk pre-acidification on initial low moisture part skim Mozzarella cheese functionality, PI Metzger, Midwest Dairy Association.

***Duration and funding:*** 5/1/01-12/31/03, \$87,500

3. **Title:** Evaluation of salt whey as an ingredient in process cheese, PI Metzger, Midwest Dairy Association.

***Duration and funding:*** 1/1/02-12/31/04, \$62,134

4. **Title:** Interpretation of the FTIR spectrum of cheese, PI Metzger, COAFES Faculty Development Grant.

***Duration and funding:*** 1/1/03-12/31/03, \$2,253

5. **Title:** Rapid measurement of intact casein and process cheese functionality, PI Metzger, Midwest Dairy Association.

***Duration and funding:*** 1/1/04-12/31/05, \$86,948

6. **Title:** Understanding the mechanisms of generation and maintenance of bioactive ACE inhibitor peptides in Cheddar cheese, PI L Metzger, Midwest Dairy Association.

***Duration and funding:*** 1/1/05-12/31/05, \$35,514.00

7. **Title:** Prevention of calcium lactate crystals in cheese, PI L Metzger, Midwest Dairy Association.

***Duration and funding:*** 9/1/05-12/31/07, \$106,445.00

**As Co-Principal Investigator**

***External grants:***

1. **Title:** Improving the flavor of soy protein as a food ingredient, PI Garry Reineccius, Co-PI Metzger, Midwest Advanced Food Manufacturing Alliance.

***Duration and funding:*** 9/1/02-12/31/03, \$46,123

2. **Title:** Improving colostrums and milk feeding management in dairy herds: Two key critical control points for Johne's Disease control programs, PI Sandra Godden, Co-PI's: S. Wells, J. Fetrow, E. Raizman, L. Metzger, J. Fertag, S. Stewart, P. Rapnicki., USDA-APHIS Veterinary Services

**Duration and funding:** 10/1/03-9/31/04, \$103,000

3. **Title:** Non-thermal Pasteurization of Milk Using Plasma Technology, PI Roger Ruan, Co-PI L. Metzger, Dairy Management Inc.

**Duration and funding:** 1/1/05-12/31/05, \$50,000

4. **Title:** Food science and nutrition national needs graduate fellowship program, PI Marla Reicks and Zata Vickers, Co-PI L. Metzger, S. Raatz, USDA/CSREES National Needs Graduate Fellowship Grant.

**Duration and funding:** 9/1/05-12/31/08, \$138,000

**University/Internal grants:**

1. **Title:** Influence of cell envelope proteinases on accelerated cheese ripening, PI Larry McKay, Co-PI Metzger, Midwest Dairy Association.

**Duration and funding:** 7/1/0-12/31/03, \$142,238

2. **Title:** Processing technologies to improve the solubility and mouth feel of dairy minerals in liquid products at neutral pH, PI Rajiv Dave, Co-PI Metzger, Midwest Dairy Association.

**Duration and funding:** 1/1/04-12/31/04, \$36,500

**Contracts:**

1. **Title:** Use of front face fluorescence as a means for online measurement and control of food quality and safety during processing, Co-PI T. Labuza and L. Metzger, Thermo Ramsey.

**Duration and funding:** 10/1/05-9/30/07, \$200,000

## **TEACHING**

### **Courses Taught**

**FScN 4312 – Food Analysis** – This course covers the application of chemical, physical, instrumental and sensory techniques in the analysis of foods and includes a lecture and a laboratory

Fall 2000 - 17 students

Fall 2001 - 23 students

Fall 2002 - 11 students

Fall 2003 – 7 students

Fall 2004 – 9 students

Fall 2005 – 17 students

**FScN 4343 – Dairy Processing** – This course covers the application of the basic concepts of food engineering and processing to the production of fluid, concentrated, and dehydrated dairy products and includes a lecture and a laboratory

Fall 2001 - 11 students

Fall 2003 - 4 students

Fall 2005 – 15 students

**FScN 8331 – Food Proteins** - Basic protein biochemistry as applied to food systems and food processing. Emphasizes forces that determine protein structure and includes a lecture and a laboratory

Fall 2002 - 13 students

### **Guest Lecturer in the following courses**

**FScN 4111 – Food Chemistry, 3 credits**

Fall 2002 – 2 lectures

Fall 2003 – 2 lectures

Fall 2004 – 3 lectures  
Fall 2005 – 4 lectures  
**FScN 8310 – Food Science Seminar, 1 credit**  
Fall 2002 – 1 lecture  
Fall 2003 – 1 lecture

## Graduate Student Advising

### Completed Graduate Students

- **Kaarin Ottman** - M.S. 2003, "Effect of manufacturing procedures on Mozzarella cheese yield and functionality"
- **Rohit Kapoor** – M.S. 2003, "Effect of ingredients and processing conditions on process cheese functional properties"; Ph.D. 2007, "Effect of intact casein, total calcium, and pH on the functional properties and microstructure of process cheese"
- **Stefka Miaka** – M.S. 2004, "Influence of cell envelope proteinases on the flavor profile and accelerated ripening of Cheddar cheese"
- **Lisa Prow** – M.S. 2004, "Development of a melt test for process cheese, process cheese spread and process cheese product using the rapid visco analyzer (RVA)"
- **Praveen Upreti** – Ph.D. 2005, "Influence of calcium and phosphorus, residual lactose, and salt-to-moisture ratio on Cheddar cheese characteristics"
- **Garimella Purna Shivananda** - M.S. 2006, "Studies on process cheese functionality"

### Current Graduate Students

- **Xiaoming Liu** – Post Doc *Project*: Development of analytical techniques for measurement of NFDM functionality
- **Melissa Nonnemacher** - Ph.D. *Project*: Generation and maintenance of bioactive peptides during Cheddar cheese ripening, expected completion date: Fall 2007
- **Chanokphat Phadungath**- Ph.D. *Project*: Prevention of calcium lactate crystals in cheese, expected completion date: Fall 2008
- **Gerry Buescher** - M.S. *Project*: Production of Parmesan and cottage cheese utilizing commercial American type cheese manufacturing equipment, expected completion date: Spring 2007
- **Alexa Hanson**- M.S. *Project*: Fortification of milk, yogurt and process cheese with Vitamin D, expected completion date: Fall 2007

## Discipline-related Service Activities

North Central Cheese Industries Association Advisor, 2001-2004  
North Central Cheese Industries Association Cheese Quality testing Workshop - Organizer and Instructor 2002  
Education Committee Chair - Minnesota section of IFT 2001  
Macy Award Committee Chair - Minnesota section of IFT 2002  
American Dairy Science Association Graduate Student Scientific Paper Competition Committee Chair, 2003  
American Dairy Science Association Foundation Board of Trustees – 2004 - present  
Wisconsin Process Cheese Seminar - Instructor 2000, 2001, 2004, 2005  
Applied Dairy chemistry Short course - Instructor 2002, 2003, 2004, 2005  
Product Development Team Advisor - 2001, 2002  
State FFA Dairy Foods Contest - Faculty Advisor 2001, 2002, 2003, 2004, 2005  
Association of Analytical Chemists International – Midwest Section Meeting – Chair of the Food Chemistry Session - 2003  
Research Seminars at - Land 'O Lakes, Arden hills, MN – 2002, 2003 and 2004; Schreiber Foods, Green Bay, WI - 2001 and 2003; First District Association, Litchfield, MN – 2002; General Mills, Minneapolis,

MN – 2003; Foss North America, Eden Prairie, MN - 2001 and 2002; AIFST/Newport Scientific/CSIRO, North Ryde, N. S. Wales, Australia – 2002; Warrnambool Cheese and Butter Factory Co. LTD., Allansford, Victoria, Australia – 2003; Bonlac Foods Limited, Wynyard, Tasmania, Australia – 2003; Bega Cheese, Bega, N. S. Wales, Australia – 2003; Dairy Industry Association of Australia, Melbourne, Victoria, Australia – 2003, and Upper Midwest Dairy Industry Association Annual Meeting, St. Cloud, MN - 2003

Outreach seminar - Galactosemic Families of Minnesota 2002 Spring Meeting

Reviewer for: *Journal of Dairy Science*, *International Dairy Journal*, *Journal of Food Quality*, *Journal of Food Science*, *Small Ruminant Nutrition*, *Cereal Chemistry*, and *Journal of Colloid and Interface Science*

### **Participation in the Governance of the University or Department**

Strategic Plan for Food Science and Nutrition - research committee member 2001

Food Science and Nutrition Club – advisor 2001 to present

Graduate Manual and Procedures Committee – Chair 2003

Graduate studies Committee – member 2003

Teaching Assistant Assignment Committee – member 2001

FScN Steering/Planning committee – member 2002 to present

COAFES Faculty Development Committee 2002 to present

Associate Director of the MN-SD Dairy Foods Research Center - Sept 2002- Jan 2003

Director of MN-SD Dairy Foods Research Center – Jan 2003- present